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Agronomic traits and growing cattle performance for whole-plant corn and forage and grain sorghum silages

Abstract

Agronomic and cattle performance traits were measured for the following silages produced in 1992: irrigated Pioneer 3377 corn, ensiled with or without Biotal® silage inoculant; DeKalb 42Y grain sorghum; and Cargill 200F, Pioneer 947, DeKalb FS-5 and FS-25E, and Northrup King (NK) 300 forage sorghums. All sorghums were grown under dryland conditions. The irrigated corn had the highest whole-plant dry matter (DM) and grain yields, and NK 300 and DeKalb FS-5 had the highest whole-plant DM yields among the sorghums. NK 300 also had the highest grain yield among the sorghums; DeKalb FS-5 and FS-25E had the lowest. Steers fed the irrigated corn silages had the fastest and most efficient gains, and the late-season forage sorghum, DeKalb FS-25E, produced the slowest and least efficient gains. Inoculating the corn silage increased DM recovery, fermentation efficiency, and steer gain per ton of crop ensiled.

Keywords

Cattlemen's Day, 1994; Kansas Agricultural Experiment Station contribution; no. 94-373-S; Report of progress (Kansas State University. Agricultural Experiment Station and Cooperative Extension Service); 704; Beef; Silage; Corn; Sorghum; Growing cattle

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**AGRONOMIC TRAITS AND GROWING CATTLE
PERFORMANCE FOR WHOLE-PLANT CORN AND FORAGE
AND GRAIN SORGHUM SILAGES ¹**

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Summary

Agronomic and cattle performance traits were measured for the following silages produced in 1992: irrigated Pioneer 3377 corn, ensiled with or without Biotal® silage inoculant; DeKalb 42Y grain sorghum; and Cargill 200F, Pioneer 947, DeKalb FS-5 and FS-25E, and Northrup King (NK) 300 forage sorghums. All sorghums were grown under dryland conditions. The irrigated corn had the highest whole-plant dry matter (DM) and grain yields, and NK 300 and DeKalb FS-5 had the highest whole-plant DM yields among the sorghums. NK 300 also had the highest grain yield among the sorghums; DeKalb FS-5 and FS-25E had the lowest. Steers fed the irrigated corn silages had the fastest and most efficient gains, and the late-season forage sorghum, DeKalb FS-25E, produced the slowest and least efficient gains. Inoculating the corn silage increased DM recovery, fermentation efficiency, and steer gain per ton of crop ensiled.

(Key Words: Silage, Corn, Sorghum, Growing Cattle.)

Introduction

Silage production in Kansas is primarily from irrigated or dryland corns and dryland grain and forage sorghums. In several previous studies, we have documented the effects of growing condition, hybrid, stage of maturity, processing, grain addition, and

climate (i.e., growing season) on the yield potential and nutritive value of numerous corn and sorghum silages. The objectives of this study were to compare both agronomic traits and cattle performance from silages produced in the 1992 growing season.

Experimental Procedures

The crops were grown near the Kansas State University campus during the 1992 season. The eight silages included irrigated Pioneer 3377 corn (with or without Biotal silage inoculant); dryland DeKalb 42Y grain sorghum; and Cargill 200F, Pioneer 947, DeKalb FS-5, Northrup King 300, and DeKalb FS-25E dryland forage sorghums. The two fields used were predominantly Reading silt loam soil. Prior to planting, anhydrous ammonia was applied at 100 lb per acre for the irrigated corn and dryland grain sorghum, and 80 lb per acre for the five forage sorghums. The corn was harvested at the 90% milk line stage of kernel maturity, and the six sorghums, at the very late-dough stage. All eight silages were made in 10 × 50 ft concrete stave silos. The silos containing the two corn silages were filled by the alternate load method.

The silos were opened on June 10 and 11, 1993 and emptied at uniform rates during the next 3 months. Silage samples were taken three times weekly. Each silage was fed to 16 yearling, crossbred steers (four pens of four steers per silage) in a 77-day growing

¹Partial financial assistance was provided by Biotal, Inc., Eden Prairie, Minnesota.

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trial, which began on June 15, 1993. The complete mixed rations were fed twice daily to appetite and contained (DM basis) 89% silage and 11% supplement. Supplements were formulated to provide rations of 12.0% crude protein, .50% calcium, and .30% phosphorus (DM basis); 250 mg of rumensin and 30,000 IU of vitamin A per steer daily.

For 5 days before the start of the growing trial, all steers were limit-fed a forage sorghum silage ration to provide a DM intake of 2.0% of body weight. Steers then were weighed individually on 2 consecutive days. For 3 days before the final weighing, the steers were fed their respective silage rations at a restricted DM intake of 2.0% of body weight. Then individual weights were taken on 2 consecutive days.

Results and Discussion

Agronomic performance and chemical composition of the seven silage crops are shown in Table 1. The corn and DeKalb

FS-5 and NK 300 had the highest whole-plant DM yields per acre; the late-season forage sorghum (DeKalb FS-25E) had the lowest DM yield. Grain yields of the five forage sorghums were above average and were highest for NK 300 and Pioneer 947. The CP values were lower and ADF values higher for the five forage sorghums than in previous years (KAES Report of Progress 678, page 16), which suggests that all were of lower than expected nutritional values. Gains and efficiencies were not related to the percent grain in the silages but were closely related to the silage ADF content.

Average daily gains and efficiencies of gain (Table 2) were excellent for steers fed the two corn silages and the DeKalb 42Y grain sorghum silage. As expected, the corn silages produced the fastest and most efficient gains. Steers fed the grain sorghum silage had the highest daily DM intake, whereas those receiving the late-season forage sorghum, DeKalb FS-25E, had the lowest DM intake and slowest and least efficient gain. Gains and efficiencies were poorer for steers fed the five forage

Table 1. Agronomic Performance and Chemical Composition of the Seven Crops and Silages in 1992

Crop, Growing Condition, and Hybrid	1992		Plant height, inches	Whole-Plant		Grain yield, bu/acre ^a	Silage ^b	
	Planting date	Harvest date		DM, %	DM yield, tons/acre		CP, %	ADF, %
<u>Corn: irrigated</u>								
Pioneer 3377	May 11	Aug. 28	108	29.8	9.4	200	7.4 ^c	24.2 ^c
<u>Grain sorghum: dryland</u>								
DeKalb 42Y	June 9	Sept. 22	54	36.2	6.9	108	8.8	27.9
<u>Forage sorghum: dryland</u>								
Cargill 200F	June 12	Sept. 23	117	37.3	6.0	105	7.0	33.0
Pioneer 947	June 12	Sept. 29	123	35.1	6.8	133	7.9	32.9
DeKalb FS-5	June 12	Sept. 28	115	32.0	7.6	96	7.7	36.5
Northrup King 300	June 12	Oct. 12	91	31.6	7.4	173	7.0	33.2
DeKalb FS-25E	June 12	Oct. 22	125	29.7	5.5	98	6.3	39.8

^aBushels/acre are adjusted to 14.5% moisture.

^bCP = crude protein, ADF = acid detergent fiber. Both are reported on a DM basis.

^cThe Biotol-treated and untreated corn silages had similar CP and ADF contents and only the mean values are reported.

sorghum silages than for those fed the corn or grain sorghum silages.

Treating the corn silage with Biotal silage inoculant did not affect rate or efficiency of gain. However, the inoculant increased DM recovery by .9 percentage units compared to the control (91.7 vs. 90.8% of the crop DM ensiled).

The inoculated silage also had a lower pH (3.72 vs. 4.02); more lactic acid; a higher lactic to acetic acid ratio (2.2 vs. 1.2); and less acetic acid, ethanol, and ammonia nitrogen compared to the control silage. When the DM recovery and feed efficiency results were combined, the inoculated corn silage produced 3.6 lb more steer gain per ton of crop ensiled than the control silage.

Table 2. Performance by Yearling Steers Fed the Eight Silage Rations in 1993

Item	Corn		Grain Sorghum	Forage Sorghum					LSD ^a (P<.05)
	Inoculated (Biotal)	Control (untreated)	DeKalb 42Y	Cargill 200F	Pioneer 947	DeKalb FS-5	NK 300	DeKalb FS-25E	
No. of steers	16	16	16	16	16	16	16	16	—
Initial wt, lb	570	572	570	568	572	575	564	567	—
Final wt, lb	808	811	769	711	731	719	731	711	71.0
ADG, lb	3.07	3.11	2.60	1.86	2.06	1.99	2.05	1.72	.3
Daily DM intake, lb	17.3	17.6	18.3	14.7	16.9	16.1	16.2	14.5	2.2
Feed/lb of gain, lb ^b	5.6	5.7	7.0	8.0	8.2	8.1	8.0	8.5	1.5

^aLSD = least significant difference. Means that differ more than the LSD are statistically different (P<.05)

^bDM basis.